

DATE: April 19, 2001

FROM: Nursing Home Initiative Estimating Team

SUBJECT: Economic Effects of Three Alternative Nursing Home Staffing Standards

TO: Richard S. Foster
Chief Actuary

NOTE: This is an internal CMS memorandum that describes work performed by the CMS Office of the Actuary to estimate costs associated with the Phase I thresholds. A more extensive analysis, based on the Phase II thresholds, is currently underway.

This memorandum presents estimates of the economic effects associated with three alternative nursing home staffing standards.

- Certified Nurse Aide (CNA) Standard: 2.0 CNA hours per resident per day
- Minimum Standard: 2.0 CNA hours per resident per day, 0.55 licensed practical nurse (LPN) hours per resident per day, 0.2 registered nurse (RN) hours per resident per day.
- Preferred Minimum Standard: 2.0 CNA hours per resident per day, 0.55 LPN hours per resident per day, 0.45 RN hours per resident per day.

These estimates reflect a state-by-state analysis of four types of nursing homes: 1) facilities which have no Medicaid patients, 2) facilities which have no Medicare patients, 3) facilities which have both Medicare and Medicaid patients, and 4) facilities which have neither Medicare nor Medicaid patients.¹

Cost Estimates. The results are summarized in Table 1, which shows the additional costs incurred by nursing home and non-nursing home sectors adjusted for savings attributable to reduced hospitalizations. (Incremental hours per patient day by state, occupation, and facility type; and additional costs by state are shown in Appendix A. Appendix B gives a more detailed discussion of the cost estimation methodology.)

¹ The analysis of incremental labor requirements by facility type was prepared by Dr. Alan White of Abt Associates and is based on 1998 data from the Online Survey Certification and Reporting (OSCAR) system covering approximately 15,000 facilities (of which about 2,000 were excluded for data quality reasons).

Table 1: Estimated CY 2001 Incremental Labor Costs (Billions)

	Nursing Home Sector	Non-Nursing Home Sector	Reduced Hospitalization s	Total Cost
CNA Standard	\$2.6	\$0.2	-\$0.2	\$2.6
Minimum Standard	\$4.6	\$0.6	-\$0.4	\$4.8
Preferred Minimum	\$7.6	\$1.9	-\$0.5	\$9.0

In the non-nursing home sector, incremental costs arise because the proposed standards will likely raise labor costs in all industries that employ CNA, LPN, and RN. In our analysis, incremental costs depend on the responsiveness of prospective CNA, LPN, and RN to changes in compensation rates. The distribution of costs between nursing home and non-nursing home sectors depends on the responsiveness of workers to changes in the relative levels of compensation between these sectors.

Three points are worth emphasizing. First, these cost estimates are constructed so that the net employment change in the non-nursing home sector is zero. In other words, we do not assume that nursing home staffing shortfalls are met by reducing staff in other health care industries. Similarly, we do not assume that existing labor shortages must be resolved before the nursing home requirements can be met.

Second, incremental costs reflect the direct costs associated with hiring additional workers and the indirect effects that result from the higher general levels of labor compensation faced by all health care providers. Therefore, it is likely that all facilities (and all patient types) will incur incremental costs even if they currently meet the proposed minima.

Finally, as we noted in our memorandum of January 8, these estimates are based on the assumption that workers and firms have fully adjusted to the new requirements and compensation levels. In fact, this adjustment would likely occur over a period of several years.

Allocation of Costs by Patient Type. Incremental labor requirements were estimated by comparing, for each facility, the observed 1998 staffing levels with the levels that would be required under each standard. Combining the calculated incremental labor requirement by facility type, with the observed patient distribution by facility type allows us to infer incremental labor requirements and costs by patient type.² The results are shown in Tables 2a (incremental costs in billions, in 2001 dollars) and 2b (percent distribution of incremental costs).

Table 2a: Distribution of Incremental Costs by Patient Type (Medicare, Medicaid, Other)
(Billions, (Includes hospitalization savings adjustment))

	Medicare	Medicaid	Other	Total
CNA Standard	\$0.2	\$1.8	\$0.6	\$2.6
Minimum Standard	\$0.4	\$3.3	\$1.1	\$4.8
Preferred Minimum	\$0.9	\$5.8	\$2.3	\$9.0

² This calculation assumes that the per-patient labor requirement for each of the three types of patients is similar across facility types.

Table 2b: Distribution of Incremental Costs by Patient Type (Medicare, Medicaid, Other)
(Percent, (Includes hospitalization savings adjustment)

	Medicare	Medicaid	Other	Total
CNA Standard	7.2%	69.9%	22.9%	100.0
Minimum Standard	8.0%	68.5%	23.5%	100.0
Preferred Minimum	9.5%	64.7%	25.8%	100.0

Economic and Policy Considerations. Our analysis suggests that the way in which the proposed standards are implemented can have significant economic and welfare consequences. The team does not necessarily advocate the policy ideas discussed below--in some cases their implications extend beyond economic theory. Rather, our intent is to bring to light economic considerations associated with certain implementation strategies.

Near Term Transition Costs. Our analysis indicates that relative compensation levels will need to increase the most in states with the greatest incremental labor requirement. However, the magnitude of these requirements implies that, at least in the near term (2-4 years), many localities will be unable to meet the proposed staffing requirements--even assuming higher compensation rates. *In fact, some research suggests that large increases in wages could exacerbate existing labor shortages in the short run.*³ This is especially true for the minimum and preferred minimum standards. In the absence of waivers, some facilities may be forced to reduce the number of residents served.⁴ We therefore recommend that waivers and/or a phase-in provision be considered as part of any implementation plan.

Labor Shortages/Cost Increases in the Non-Nursing Home Sector. As noted earlier, the cost estimates above assume a change in labor market conditions that brings about the desired employment changes in the nursing home industry *without affecting net employment in the non-nursing home sector.* We conclude that this cannot be accomplished without compensation increases in the non-nursing home sector--particularly in areas where there are already labor shortages and where incremental nursing home labor requirements are large. Thus, a change in policy, which does not address compensation issues across industries, is likely to exacerbate existing labor shortages in the non-nursing home sector, especially for registered nurses and particularly in the South.

³ For example, Chiha and Link estimate that short-run RN labor supply own wage elasticities range from -0.12 to -0.24 for married RN and from 0.05 to 0.09 for single RN. These results suggest that it will be virtually impossible to meet the RN minima in the short run with wage increases alone. Chiha, Yvana A. and Link, Charles R., "The Shortage of Registered Nurses and Some New Estimates of the Effects of Wages on RN Labor Supply: A Look at the Past, and a Preview of What's to Come in the 21st Century?", draft manuscript, University of Delaware, January 26, 2001.

⁴ This study does not account for the welfare impacts associated with reductions in nursing home capacity in particular localities.

Contract Nursing. As noted above, our cost estimates consider two types of costs: the direct costs of recruiting, training, and paying new workers, and the indirect costs associated with the higher general levels of compensation paid to current workers in the affected occupations. It is possible, however, that the use of contract staffing could permit different rates of compensation for new and existing workers, thereby mitigating the indirect cost effects of the proposed standards. We conclude that contract nursing has limited potential to lessen indirect costs for two reasons. First, in the long run, we would expect wage differentials between contract nursing home staff and permanent staff to be reduced to a point that reflects a premium for the presumed disadvantages associated with contract employment. Second, current participation rates are so high that it is difficult to envision contract labor meeting the incremental demand (again, particularly in states with existing shortages and larger incremental labor requirements).⁵

Caveats. Ideally, the evaluation of a proposed policy change compares two conditions: 1) the state of the world assuming the specific policy change is implemented, and 2) a baseline condition assuming that the specific policy change is not implemented. In practice, however, projecting costs into the future is problematic owing to the difficulties in forecasting baseline conditions. In the absence of government regulation, will existing labor shortages worsen in the future? How might relative compensation levels respond to deepening labor shortages? How will changes in the population affect the (baseline) demand for nursing home services?

The cost estimates above use current (CY 2001) labor market conditions and nursing home resident populations as a baseline. What follows is a discussion of variables that could affect the baseline assumptions.

Alternative Employment. Estimates of the long-run own-wage elasticity of RN labor supply control for changes in compensation for alternative employment. Our analysis implicitly assumes that, on average, real compensation for alternative work is constant. In fact, rising (falling) real average wages of alternative employment, *ceteris paribus*, would likely increase (decrease) the costs of hiring additional nursing home RN staff.

Foreign Nurses. Currently, the U.S. government grants working papers to 500 foreign nurses per year to address shortages.⁶ Liberalizing the restrictions on foreign nurses would tend to reduce the incremental costs associated with the proposed standards (assuming that there are no other costs associated with this change in policy).

Labor Supply Demographics. It is also possible that changes in the population of potential CNA, LPN and RN could affect future costs. For example, Chiha and Link found a statistically significant relationship between RN school admissions and the population of 18-24 year old

⁵ "...participation rates for married and single female nurses have increased consistently over the years, and in 1996 exceeded 88% for married female RNs and 90% for single female RNs....Not only are RNs likely to work, but also when they do work they tend to work full-time. In both years, more than two-thirds of married female RNs, the group with the lowest participation rates, worked more than 1,500 hours per year. More than 40% percent of married nurses worked at least 2,000 hours annually. The numbers are even higher for single female RNs, where about 85% worked at least 1,500 hours and more than 55% worked at least 2,000 hours." Chiha and Link, *op. cit.*

⁶ *Ibid.*

women. The long run incremental costs associated with the proposed RN staffing standards could increase as the size of this population decreases over time.

Resident Population. Growth in the population demanding nursing home services, all other things constant, would tend to increase nursing home labor costs. If one postulates that current (baseline) staff per resident/day proportions are maintained in the future in the absence of any government regulation, then incremental costs associated with the proposed standards would grow at a rate equal to the growth rate of the resident population. It is possible, however, that in the absence of regulation, even today's staff per patient/day ratios would not be maintained. In this case, the costs estimated here would grow faster than the growth of the resident population.

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Appendix A: State Level Cost Estimates

Table A.1: CNA and LPN Costs by State
(Billions, CY2001 \$)

State	CNA			LPN		
	NH	Non-NH	Total	NH	Non-NH	Total
Alaska	\$0.000	\$0.000	\$0.000	\$0.001	\$0.000	\$0.001
Alabama	\$0.007	\$0.000	\$0.007	\$0.001	\$0.000	\$0.001
Arkansas	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000
Arizona	\$0.015	\$0.001	\$0.015	\$0.004	\$0.001	\$0.004
California	\$0.109	\$0.005	\$0.114	\$0.113	\$0.015	\$0.128
Colorado	\$0.034	\$0.001	\$0.035	\$0.010	\$0.001	\$0.011
Connecticut	\$0.048	\$0.002	\$0.051	\$0.053	\$0.013	\$0.065
District of Columbia	\$0.001	\$0.000	\$0.001	\$0.001	\$0.000	\$0.001
Delaware	\$0.001	\$0.000	\$0.001	\$0.002	\$0.000	\$0.003
Florida	\$0.100	\$0.004	\$0.104	\$0.018	\$0.003	\$0.021
Georgia	\$0.046	\$0.002	\$0.048	\$0.004	\$0.001	\$0.005
Hawaii	\$0.000	\$0.000	\$0.000	\$0.008	\$0.003	\$0.011
Iowa	\$0.102	\$0.011	\$0.113	\$0.043	\$0.010	\$0.053
Idaho	\$0.002	\$0.000	\$0.002	\$0.003	\$0.000	\$0.003
Illinois	\$0.329	\$0.036	\$0.364	\$0.198	\$0.054	\$0.252
Indiana	\$0.188	\$0.026	\$0.214	\$0.013	\$0.002	\$0.015
Kansas	\$0.093	\$0.012	\$0.106	\$0.029	\$0.006	\$0.035
Kentucky	\$0.036	\$0.001	\$0.038	\$0.008	\$0.001	\$0.010
Louisiana	\$0.035	\$0.001	\$0.036	\$0.006	\$0.001	\$0.006
Massachusetts	\$0.035	\$0.002	\$0.036	\$0.049	\$0.006	\$0.055
Maryland	\$0.035	\$0.002	\$0.037	\$0.024	\$0.004	\$0.028
Maine	\$0.001	\$0.000	\$0.001	\$0.013	\$0.004	\$0.016
Michigan	\$0.031	\$0.002	\$0.033	\$0.032	\$0.004	\$0.037
Minnesota	\$0.092	\$0.003	\$0.095	\$0.021	\$0.003	\$0.024
Missouri	\$0.132	\$0.020	\$0.152	\$0.028	\$0.004	\$0.031
Mississippi	\$0.026	\$0.001	\$0.027	\$0.001	\$0.000	\$0.002
Montana	\$0.002	\$0.000	\$0.002	\$0.006	\$0.001	\$0.008
North Carolina	\$0.033	\$0.002	\$0.034	\$0.018	\$0.002	\$0.020
North Dakota	\$0.003	\$0.000	\$0.004	\$0.006	\$0.001	\$0.007
Nebraska	\$0.044	\$0.003	\$0.048	\$0.012	\$0.002	\$0.014
New Hampshire	\$0.004	\$0.000	\$0.004	\$0.010	\$0.002	\$0.013
New Jersey	\$0.059	\$0.003	\$0.061	\$0.066	\$0.014	\$0.080
New Mexico	\$0.008	\$0.000	\$0.008	\$0.007	\$0.002	\$0.009
Nevada	\$0.013	\$0.001	\$0.014	\$0.004	\$0.001	\$0.005
New York	\$0.189	\$0.008	\$0.198	\$0.094	\$0.012	\$0.106
Ohio	\$0.120	\$0.005	\$0.125	\$0.031	\$0.004	\$0.036
Oklahoma	\$0.074	\$0.014	\$0.089	\$0.016	\$0.003	\$0.019
Oregon	\$0.012	\$0.001	\$0.013	\$0.027	\$0.009	\$0.036
Pennsylvania	\$0.098	\$0.004	\$0.103	\$0.055	\$0.007	\$0.062
Rhode Island	\$0.018	\$0.001	\$0.018	\$0.031	\$0.011	\$0.042
South Carolina	\$0.011	\$0.001	\$0.011	\$0.002	\$0.000	\$0.002
South Dakota	\$0.009	\$0.000	\$0.009	\$0.014	\$0.004	\$0.018
Tennessee	\$0.079	\$0.002	\$0.081	\$0.011	\$0.002	\$0.012
Texas	\$0.196	\$0.017	\$0.213	\$0.031	\$0.004	\$0.035
Utah	\$0.011	\$0.000	\$0.012	\$0.005	\$0.001	\$0.007
Virginia	\$0.037	\$0.002	\$0.039	\$0.004	\$0.001	\$0.004
Vermont	\$0.002	\$0.000	\$0.002	\$0.002	\$0.000	\$0.003
Washington	\$0.010	\$0.001	\$0.011	\$0.025	\$0.005	\$0.029
Wisconsin	\$0.036	\$0.002	\$0.037	\$0.076	\$0.020	\$0.096
West Virginia	\$0.003	\$0.000	\$0.003	\$0.002	\$0.000	\$0.003
Wyoming	\$0.003	\$0.000	\$0.003	\$0.003	\$0.001	\$0.004
Total	\$2.575	\$0.199	\$2.774	\$1.242	\$0.245	\$1.487

Table A.2: RN Costs by Scenario and State
(Billions, CY2001 \$

State	RN (0.2 hrs per resident/day)			RN (0.45 hrs per resident/day)		
	NH	Non-NH	Total	NH	Non-NH	Total
Alaska	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000
Alabama	\$0.016	\$0.000	\$0.016	\$0.073	\$0.037	\$0.110
Arkansas	\$0.031	\$0.016	\$0.046	\$0.092	\$0.055	\$0.147
Arizona	\$0.001	\$0.000	\$0.001	\$0.021	\$0.005	\$0.026
California	\$0.061	\$0.002	\$0.064	\$0.324	\$0.098	\$0.422
Colorado	\$0.001	\$0.000	\$0.001	\$0.022	\$0.006	\$0.028
Connecticut	\$0.002	\$0.000	\$0.002	\$0.028	\$0.008	\$0.036
District of Columbia	\$0.001	\$0.000	\$0.001	\$0.006	\$0.002	\$0.009
Delaware	\$0.001	\$0.000	\$0.001	\$0.003	\$0.001	\$0.004
Florida	\$0.027	\$0.001	\$0.028	\$0.174	\$0.060	\$0.234
Georgia	\$0.046	\$0.018	\$0.064	\$0.153	\$0.092	\$0.245
Hawaii	\$0.000	\$0.000	\$0.001	\$0.005	\$0.002	\$0.007
Iowa	\$0.007	\$0.000	\$0.007	\$0.059	\$0.015	\$0.074
Idaho	\$0.001	\$0.000	\$0.001	\$0.008	\$0.002	\$0.010
Illinois	\$0.038	\$0.001	\$0.040	\$0.205	\$0.046	\$0.251
Indiana	\$0.024	\$0.001	\$0.024	\$0.127	\$0.050	\$0.177
Kansas	\$0.012	\$0.000	\$0.012	\$0.067	\$0.024	\$0.092
Kentucky	\$0.015	\$0.000	\$0.016	\$0.069	\$0.029	\$0.098
Louisiana	\$0.058	\$0.032	\$0.090	\$0.162	\$0.100	\$0.262
Massachusetts	\$0.005	\$0.000	\$0.006	\$0.069	\$0.020	\$0.089
Maryland	\$0.004	\$0.000	\$0.005	\$0.045	\$0.011	\$0.056
Maine	\$0.001	\$0.000	\$0.001	\$0.005	\$0.002	\$0.007
Michigan	\$0.011	\$0.001	\$0.012	\$0.091	\$0.024	\$0.115
Minnesota	\$0.012	\$0.001	\$0.013	\$0.105	\$0.028	\$0.133
Missouri	\$0.034	\$0.000	\$0.034	\$0.127	\$0.059	\$0.186
Mississippi	\$0.016	\$0.000	\$0.016	\$0.059	\$0.029	\$0.088
Montana	\$0.002	\$0.000	\$0.002	\$0.009	\$0.002	\$0.011
North Carolina	\$0.009	\$0.000	\$0.010	\$0.088	\$0.020	\$0.108
North Dakota	\$0.001	\$0.000	\$0.001	\$0.015	\$0.005	\$0.020
Nebraska	\$0.004	\$0.000	\$0.004	\$0.034	\$0.009	\$0.043
New Hampshire	\$0.000	\$0.000	\$0.001	\$0.005	\$0.001	\$0.006
New Jersey	\$0.004	\$0.000	\$0.004	\$0.066	\$0.019	\$0.084
New Mexico	\$0.002	\$0.000	\$0.002	\$0.012	\$0.004	\$0.016
Nevada	\$0.000	\$0.000	\$0.000	\$0.007	\$0.002	\$0.009
New York	\$0.051	\$0.002	\$0.053	\$0.296	\$0.096	\$0.392
Ohio	\$0.016	\$0.001	\$0.017	\$0.150	\$0.037	\$0.187
Oklahoma	\$0.030	\$0.015	\$0.046	\$0.091	\$0.055	\$0.146
Oregon	\$0.001	\$0.000	\$0.001	\$0.017	\$0.005	\$0.022
Pennsylvania	\$0.009	\$0.000	\$0.009	\$0.140	\$0.038	\$0.178
Rhode Island	\$0.001	\$0.000	\$0.001	\$0.012	\$0.003	\$0.015
South Carolina	\$0.011	\$0.000	\$0.011	\$0.044	\$0.022	\$0.066
South Dakota	\$0.000	\$0.000	\$0.000	\$0.004	\$0.001	\$0.005
Tennessee	\$0.037	\$0.007	\$0.044	\$0.133	\$0.070	\$0.203
Texas	\$0.114	\$0.038	\$0.152	\$0.353	\$0.204	\$0.557
Utah	\$0.003	\$0.000	\$0.003	\$0.014	\$0.004	\$0.018
Virginia	\$0.015	\$0.000	\$0.016	\$0.071	\$0.031	\$0.102
Vermont	\$0.001	\$0.000	\$0.001	\$0.005	\$0.001	\$0.006
Washington	\$0.001	\$0.000	\$0.001	\$0.015	\$0.005	\$0.020
Wisconsin	\$0.001	\$0.000	\$0.001	\$0.033	\$0.010	\$0.042
West Virginia	\$0.006	\$0.000	\$0.007	\$0.019	\$0.010	\$0.030
Wyoming	\$0.000	\$0.000	\$0.000	\$0.003	\$0.001	\$0.003
Total	\$0.745	\$0.140	\$0.885	\$3.735	\$1.461	\$5.196

Table A.3: Minimum and Preferred Minimum Costs by State
(Billions, CY2001 \$

State	Minimum Scenario			Preferred Minimum Scenario		
	NH	Non-NH	Total	NH	Non-NH	Total
Alaska	\$0.001	\$0.000	\$0.001	\$0.001	\$0.000	\$0.001
Alabama	\$0.023	\$0.000	\$0.024	\$0.081	\$0.038	\$0.118
Arkansas	\$0.031	\$0.016	\$0.046	\$0.092	\$0.055	\$0.147
Arizona	\$0.020	\$0.001	\$0.021	\$0.039	\$0.007	\$0.046
California	\$0.284	\$0.023	\$0.307	\$0.546	\$0.118	\$0.665
Colorado	\$0.045	\$0.003	\$0.048	\$0.066	\$0.009	\$0.074
Connecticut	\$0.103	\$0.015	\$0.118	\$0.129	\$0.023	\$0.152
District of Columbia	\$0.003	\$0.000	\$0.003	\$0.008	\$0.002	\$0.011
Delaware	\$0.004	\$0.000	\$0.005	\$0.007	\$0.001	\$0.008
Florida	\$0.145	\$0.008	\$0.153	\$0.292	\$0.067	\$0.360
Georgia	\$0.096	\$0.021	\$0.116	\$0.203	\$0.095	\$0.297
Hawaii	\$0.009	\$0.003	\$0.012	\$0.014	\$0.004	\$0.018
Iowa	\$0.152	\$0.021	\$0.173	\$0.204	\$0.036	\$0.240
Idaho	\$0.006	\$0.001	\$0.006	\$0.013	\$0.002	\$0.015
Illinois	\$0.565	\$0.091	\$0.656	\$0.732	\$0.136	\$0.868
Indiana	\$0.225	\$0.028	\$0.253	\$0.328	\$0.077	\$0.405
Kansas	\$0.135	\$0.018	\$0.153	\$0.190	\$0.042	\$0.232
Kentucky	\$0.060	\$0.003	\$0.063	\$0.113	\$0.032	\$0.145
Louisiana	\$0.098	\$0.034	\$0.132	\$0.202	\$0.102	\$0.304
Massachusetts	\$0.089	\$0.008	\$0.097	\$0.152	\$0.028	\$0.180
Maryland	\$0.063	\$0.006	\$0.069	\$0.104	\$0.016	\$0.120
Maine	\$0.014	\$0.004	\$0.018	\$0.019	\$0.005	\$0.025
Michigan	\$0.075	\$0.006	\$0.082	\$0.155	\$0.029	\$0.185
Minnesota	\$0.125	\$0.006	\$0.132	\$0.219	\$0.034	\$0.252
Missouri	\$0.194	\$0.023	\$0.217	\$0.287	\$0.082	\$0.369
Mississippi	\$0.043	\$0.001	\$0.044	\$0.086	\$0.030	\$0.116
Montana	\$0.010	\$0.002	\$0.012	\$0.018	\$0.004	\$0.021
North Carolina	\$0.060	\$0.005	\$0.064	\$0.138	\$0.025	\$0.163
North Dakota	\$0.011	\$0.001	\$0.012	\$0.024	\$0.006	\$0.030
Nebraska	\$0.060	\$0.005	\$0.065	\$0.091	\$0.014	\$0.105
New Hampshire	\$0.015	\$0.003	\$0.018	\$0.019	\$0.004	\$0.023
New Jersey	\$0.129	\$0.017	\$0.146	\$0.191	\$0.036	\$0.226
New Mexico	\$0.016	\$0.003	\$0.019	\$0.026	\$0.007	\$0.033
Nevada	\$0.017	\$0.002	\$0.019	\$0.024	\$0.004	\$0.028
New York	\$0.334	\$0.022	\$0.357	\$0.580	\$0.116	\$0.696
Ohio	\$0.167	\$0.010	\$0.177	\$0.301	\$0.046	\$0.347
Oklahoma	\$0.121	\$0.032	\$0.153	\$0.182	\$0.072	\$0.254
Oregon	\$0.040	\$0.010	\$0.050	\$0.056	\$0.014	\$0.071
Pennsylvania	\$0.161	\$0.012	\$0.174	\$0.293	\$0.049	\$0.342
Rhode Island	\$0.050	\$0.012	\$0.062	\$0.061	\$0.015	\$0.076
South Carolina	\$0.023	\$0.001	\$0.024	\$0.057	\$0.022	\$0.079
South Dakota	\$0.023	\$0.005	\$0.028	\$0.027	\$0.006	\$0.033
Tennessee	\$0.127	\$0.011	\$0.138	\$0.222	\$0.074	\$0.296
Texas	\$0.340	\$0.060	\$0.400	\$0.579	\$0.225	\$0.805
Utah	\$0.019	\$0.002	\$0.021	\$0.031	\$0.005	\$0.037
Virginia	\$0.056	\$0.003	\$0.059	\$0.112	\$0.034	\$0.145
Vermont	\$0.005	\$0.000	\$0.005	\$0.009	\$0.002	\$0.011
Washington	\$0.036	\$0.005	\$0.041	\$0.050	\$0.010	\$0.060
Wisconsin	\$0.114	\$0.022	\$0.135	\$0.145	\$0.031	\$0.176
West Virginia	\$0.011	\$0.001	\$0.012	\$0.025	\$0.011	\$0.036
Wyoming	\$0.006	\$0.001	\$0.007	\$0.009	\$0.002	\$0.010
Total	\$4.562	\$0.585	\$5.146	\$7.551	\$1.906	\$9.457

Table A.4: Incremental Hours Per Day by State

State	CNA	LPN	RN(0.2)	RN(0.45)
Alaska	-	33	-	-
Alabama	949	49	745	5,031
Arkansas	3,981	483	2,160	6,523
Arizona	1,718	282	59	1,121
California	12,088	6,992	2,220	14,352
Colorado	3,736	732	56	1,177
Connecticut	3,891	3,067	78	1,369
District of Columbia	126	37	38	323
Delaware	157	164	30	169
Florida	11,600	1,344	1,201	9,899
Georgia	5,691	358	2,851	10,593
Hawaii	41	618	17	213
Iowa	12,203	3,801	384	3,906
Idaho	275	230	33	441
Illinois	38,948	15,912	1,822	11,250
Indiana	23,218	1,018	1,143	8,066
Kansas	11,733	2,555	595	4,255
Kentucky	4,487	721	724	4,420
Louisiana	5,102	489	3,710	10,372
Massachusetts	3,419	2,943	206	3,258
Maryland	3,728	1,552	189	2,263
Maine	146	1,100	36	333
Michigan	3,426	2,282	487	4,628
Minnesota	9,251	1,632	490	5,003
Missouri	17,857	2,323	1,584	8,390
Mississippi	3,506	132	727	3,853
Montana	257	625	98	585
North Carolina	4,020	1,387	422	4,600
North Dakota	443	559	71	917
Nebraska	5,172	1,043	196	2,083
New Hampshire	427	811	24	293
New Jersey	5,573	4,356	149	3,077
New Mexico	961	616	78	713
Nevada	1,338	274	10	354
New York	16,983	6,364	1,921	13,881
Ohio	13,646	2,363	768	8,376
Oklahoma	11,347	1,470	2,164	6,663
Oregon	1,392	2,108	60	891
Pennsylvania	10,216	3,991	402	7,571
Rhode Island	1,844	2,091	36	578
South Carolina	1,408	133	512	2,961
South Dakota	1,113	1,312	7	263
Tennessee	9,490	949	2,050	9,052
Texas	27,659	2,359	6,463	23,067
Utah	1,302	475	114	764
Virginia	4,558	312	701	4,437
Vermont	198	175	46	287
Washington	1,126	1,787	35	779
Wisconsin	3,911	6,107	68	1,954
West Virginia	404	218	313	1,406
Wyoming	393	301	1	169
Total	306,457	93,036	38,295	216,928

Table A.5: Incremental Hours Per Day
(As a percent of total nursing home hours per day)

State	CNA	LPN	RN(0.2)	RN(0.45)
Alaska	0.0%	9.9%	0.0%	0.0%
Alabama	1.7%	0.2%	14.2%	96.1%
Arkansas	11.5%	3.7%	87.2%	263.3%
Arizona	8.1%	3.7%	1.2%	22.3%
California	6.1%	11.9%	5.9%	38.0%
Colorado	13.0%	7.2%	0.7%	15.5%
Connecticut	7.6%	25.4%	0.6%	10.7%
District of Columbia	2.5%	2.1%	5.0%	42.3%
Delaware	2.1%	8.4%	1.4%	8.0%
Florida	9.9%	2.8%	5.3%	43.8%
Georgia	8.3%	1.3%	48.4%	179.8%
Hawaii	0.5%	37.2%	0.8%	10.7%
Iowa	27.8%	29.7%	3.6%	36.8%
Idaho	2.7%	8.3%	1.8%	24.4%
Illinois	29.5%	46.3%	4.9%	30.6%
Indiana	37.1%	3.0%	8.3%	58.8%
Kansas	33.3%	21.0%	7.6%	54.5%
Kentucky	10.7%	4.4%	10.4%	63.3%
Louisiana	9.5%	2.5%	98.0%	274.0%
Massachusetts	3.2%	10.6%	0.8%	12.6%
Maryland	9.9%	14.0%	2.2%	26.9%
Maine	0.8%	37.3%	0.8%	7.8%
Michigan	4.1%	10.1%	3.4%	32.6%
Minnesota	13.6%	6.8%	3.6%	36.4%
Missouri	30.4%	9.9%	15.0%	79.7%
Mississippi	11.5%	1.1%	16.7%	88.7%
Montana	2.1%	21.5%	3.7%	22.3%
North Carolina	5.1%	5.0%	2.8%	30.7%
North Dakota	3.1%	17.3%	3.4%	44.7%
Nebraska	21.1%	12.3%	3.5%	36.9%
New Hampshire	2.6%	23.4%	0.6%	7.1%
New Jersey	6.7%	20.1%	0.7%	14.9%
New Mexico	10.6%	29.1%	4.8%	43.6%
Nevada	21.9%	12.1%	0.5%	18.7%
New York	9.0%	11.0%	5.7%	41.0%
Ohio	9.0%	4.2%	2.3%	25.5%
Oklahoma	40.3%	12.9%	76.1%	234.4%
Oregon	6.4%	52.0%	1.2%	17.3%
Pennsylvania	5.9%	7.0%	1.0%	18.5%
Rhode Island	10.3%	72.9%	0.8%	13.3%
South Carolina	4.8%	1.2%	13.0%	74.9%
South Dakota	10.0%	63.2%	0.2%	8.3%
Tennessee	15.3%	3.8%	26.4%	116.5%
Texas	20.5%	4.1%	39.7%	141.6%
Utah	12.4%	15.6%	4.9%	32.4%
Virginia	9.9%	1.7%	9.7%	61.4%
Vermont	3.3%	9.7%	4.2%	26.6%
Washington	2.3%	15.5%	0.3%	6.2%
Wisconsin	4.8%	37.6%	0.3%	9.7%
West Virginia	3.2%	5.0%	19.2%	86.2%
Wyoming	7.8%	25.7%	0.1%	13.7%
Total (Average)	11.6%	10.6%	7.4%	41.8%

Table A.6: Nursing Home Direct Hiring (Recruiting, Training, and Compensation) Costs
(Billions, CY2001 \$)

State	CNA	LPN	RN(0.2)	RN(0.45)
Alaska	\$ -	\$ 0.000	\$ -	\$ -
Alabama	\$ 0.004	\$ 0.000	\$ 0.009	\$ 0.062
Arkansas	\$ -	\$ -	\$ 0.026	\$ 0.085
Arizona	\$ 0.009	\$ 0.002	\$ 0.001	\$ 0.014
California	\$ 0.065	\$ 0.074	\$ 0.032	\$ 0.234
Colorado	\$ 0.021	\$ 0.006	\$ 0.001	\$ 0.014
Connecticut	\$ 0.029	\$ 0.038	\$ 0.001	\$ 0.018
District of Columbia	\$ 0.001	\$ 0.000	\$ 0.000	\$ 0.005
Delaware	\$ 0.001	\$ 0.002	\$ 0.000	\$ 0.002
Florida	\$ 0.061	\$ 0.012	\$ 0.014	\$ 0.130
Georgia	\$ 0.028	\$ 0.003	\$ 0.035	\$ 0.139
Hawaii	\$ 0.000	\$ 0.006	\$ 0.000	\$ 0.003
Iowa	\$ 0.069	\$ 0.032	\$ 0.003	\$ 0.041
Idaho	\$ 0.001	\$ 0.002	\$ 0.000	\$ 0.005
Illinois	\$ 0.224	\$ 0.152	\$ 0.020	\$ 0.139
Indiana	\$ 0.133	\$ 0.008	\$ 0.012	\$ 0.099
Kansas	\$ 0.065	\$ 0.021	\$ 0.006	\$ 0.051
Kentucky	\$ 0.022	\$ 0.005	\$ 0.008	\$ 0.055
Louisiana	\$ 0.021	\$ 0.004	\$ 0.050	\$ 0.151
Massachusetts	\$ 0.021	\$ 0.032	\$ 0.003	\$ 0.045
Maryland	\$ 0.021	\$ 0.016	\$ 0.002	\$ 0.030
Maine	\$ 0.001	\$ 0.010	\$ 0.000	\$ 0.004
Michigan	\$ 0.019	\$ 0.021	\$ 0.006	\$ 0.063
Minnesota	\$ 0.056	\$ 0.014	\$ 0.006	\$ 0.074
Missouri	\$ 0.093	\$ 0.018	\$ 0.018	\$ 0.104
Mississippi	\$ 0.016	\$ 0.001	\$ 0.009	\$ 0.050
Montana	\$ 0.001	\$ 0.005	\$ 0.001	\$ 0.006
North Carolina	\$ 0.019	\$ 0.011	\$ 0.005	\$ 0.060
North Dakota	\$ 0.002	\$ 0.004	\$ 0.001	\$ 0.011
Nebraska	\$ 0.029	\$ 0.008	\$ 0.002	\$ 0.024
New Hampshire	\$ 0.002	\$ 0.007	\$ 0.000	\$ 0.003
New Jersey	\$ 0.035	\$ 0.047	\$ 0.002	\$ 0.043
New Mexico	\$ 0.005	\$ 0.005	\$ 0.001	\$ 0.009
Nevada	\$ 0.009	\$ 0.003	\$ 0.000	\$ 0.005
New York	\$ 0.114	\$ 0.061	\$ 0.026	\$ 0.217
Ohio	\$ 0.072	\$ 0.020	\$ 0.008	\$ 0.101
Oklahoma	\$ 0.054	\$ 0.011	\$ 0.025	\$ 0.084
Oregon	\$ 0.007	\$ 0.022	\$ 0.001	\$ 0.011
Pennsylvania	\$ 0.059	\$ 0.035	\$ 0.004	\$ 0.093
Rhode Island	\$ 0.011	\$ 0.025	\$ 0.000	\$ 0.008
South Carolina	\$ 0.006	\$ 0.001	\$ 0.006	\$ 0.037
South Dakota	\$ 0.005	\$ 0.011	\$ 0.000	\$ 0.003
Tennessee	\$ 0.049	\$ 0.007	\$ 0.024	\$ 0.115
Texas	\$ 0.128	\$ 0.020	\$ 0.083	\$ 0.313
Utah	\$ 0.007	\$ 0.004	\$ 0.001	\$ 0.010
Virginia	\$ 0.022	\$ 0.002	\$ 0.008	\$ 0.057
Vermont	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.003
Washington	\$ 0.006	\$ 0.017	\$ 0.000	\$ 0.010
Wisconsin	\$ 0.021	\$ 0.058	\$ 0.001	\$ 0.021
West Virginia	\$ 0.002	\$ 0.001	\$ 0.004	\$ 0.016
Wyoming	\$ 0.002	\$ 0.002	\$ 0.000	\$ 0.002
Total	\$ 1.649	\$ 0.868	\$ 0.468	\$ 2.878

Table A.7: Nursing Home InDirect Costs
(Billions, CY2001 \$)

State	CNA	LPN	RN(0.2)	RN(0.45)
Alaska	\$ -	\$ 0.000	\$ -	\$ -
Alabama	\$ 0.003	\$ 0.000	\$ 0.007	\$ 0.011
Arkansas	\$ -	\$ -	\$ 0.005	\$ 0.007
Arizona	\$ 0.006	\$ 0.001	\$ 0.001	\$ 0.007
California	\$ 0.044	\$ 0.039	\$ 0.030	\$ 0.091
Colorado	\$ 0.013	\$ 0.003	\$ 0.001	\$ 0.007
Connecticut	\$ 0.019	\$ 0.014	\$ 0.001	\$ 0.010
District of Columbia	\$ 0.000	\$ 0.000	\$ 0.000	\$ 0.002
Delaware	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.001
Florida	\$ 0.040	\$ 0.007	\$ 0.013	\$ 0.044
Georgia	\$ 0.018	\$ 0.001	\$ 0.011	\$ 0.014
Hawaii	\$ 0.000	\$ 0.002	\$ 0.000	\$ 0.002
Iowa	\$ 0.033	\$ 0.012	\$ 0.003	\$ 0.018
Idaho	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.003
Illinois	\$ 0.105	\$ 0.046	\$ 0.019	\$ 0.066
Indiana	\$ 0.056	\$ 0.005	\$ 0.011	\$ 0.028
Kansas	\$ 0.028	\$ 0.009	\$ 0.006	\$ 0.016
Kentucky	\$ 0.014	\$ 0.003	\$ 0.007	\$ 0.014
Louisiana	\$ 0.014	\$ 0.002	\$ 0.008	\$ 0.012
Massachusetts	\$ 0.014	\$ 0.017	\$ 0.003	\$ 0.024
Maryland	\$ 0.014	\$ 0.008	\$ 0.002	\$ 0.015
Maine	\$ 0.000	\$ 0.003	\$ 0.000	\$ 0.002
Michigan	\$ 0.013	\$ 0.011	\$ 0.005	\$ 0.028
Minnesota	\$ 0.036	\$ 0.008	\$ 0.006	\$ 0.031
Missouri	\$ 0.040	\$ 0.010	\$ 0.016	\$ 0.022
Mississippi	\$ 0.010	\$ 0.001	\$ 0.007	\$ 0.010
Montana	\$ 0.001	\$ 0.002	\$ 0.001	\$ 0.003
North Carolina	\$ 0.013	\$ 0.006	\$ 0.005	\$ 0.028
North Dakota	\$ 0.001	\$ 0.002	\$ 0.001	\$ 0.004
Nebraska	\$ 0.015	\$ 0.004	\$ 0.002	\$ 0.010
New Hampshire	\$ 0.002	\$ 0.003	\$ 0.000	\$ 0.002
New Jersey	\$ 0.024	\$ 0.019	\$ 0.002	\$ 0.022
New Mexico	\$ 0.003	\$ 0.002	\$ 0.001	\$ 0.003
Nevada	\$ 0.004	\$ 0.001	\$ 0.000	\$ 0.002
New York	\$ 0.075	\$ 0.033	\$ 0.025	\$ 0.079
Ohio	\$ 0.047	\$ 0.011	\$ 0.008	\$ 0.049
Oklahoma	\$ 0.020	\$ 0.005	\$ 0.005	\$ 0.007
Oregon	\$ 0.005	\$ 0.005	\$ 0.001	\$ 0.006
Pennsylvania	\$ 0.039	\$ 0.020	\$ 0.004	\$ 0.047
Rhode Island	\$ 0.007	\$ 0.006	\$ 0.000	\$ 0.004
South Carolina	\$ 0.004	\$ 0.001	\$ 0.005	\$ 0.008
South Dakota	\$ 0.004	\$ 0.003	\$ 0.000	\$ 0.001
Tennessee	\$ 0.030	\$ 0.004	\$ 0.013	\$ 0.018
Texas	\$ 0.068	\$ 0.011	\$ 0.030	\$ 0.039
Utah	\$ 0.004	\$ 0.002	\$ 0.001	\$ 0.004
Virginia	\$ 0.015	\$ 0.001	\$ 0.007	\$ 0.014
Vermont	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.002
Washington	\$ 0.004	\$ 0.008	\$ 0.000	\$ 0.005
Wisconsin	\$ 0.014	\$ 0.019	\$ 0.001	\$ 0.011
West Virginia	\$ 0.001	\$ 0.001	\$ 0.003	\$ 0.003
Wyoming	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.001
Total	\$ 0.925	\$ 0.374	\$ 0.277	\$ 0.856

Table A.8: Non-Nursing Home Indirect Costs
(Billions, CY2001 \$)

State	CNA	LPN	RN(0.2)	RN(0.45)
Alaska	\$ -	\$ 0.000	\$ -	\$ -
Alabama	\$ 0.000	\$ 0.000	\$ 0.000	\$ 0.037
Arkansas	\$ -	\$ -	\$ 0.016	\$ 0.055
Arizona	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.005
California	\$ 0.005	\$ 0.015	\$ 0.002	\$ 0.098
Colorado	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.006
Connecticut	\$ 0.002	\$ 0.013	\$ 0.000	\$ 0.008
District of Columbia	\$ 0.000	\$ 0.000	\$ 0.000	\$ 0.002
Delaware	\$ 0.000	\$ 0.000	\$ 0.000	\$ 0.001
Florida	\$ 0.004	\$ 0.003	\$ 0.001	\$ 0.060
Georgia	\$ 0.002	\$ 0.001	\$ 0.018	\$ 0.092
Hawaii	\$ 0.000	\$ 0.003	\$ 0.000	\$ 0.002
Iowa	\$ 0.011	\$ 0.010	\$ 0.000	\$ 0.015
Idaho	\$ 0.000	\$ 0.000	\$ 0.000	\$ 0.002
Illinois	\$ 0.036	\$ 0.054	\$ 0.001	\$ 0.046
Indiana	\$ 0.026	\$ 0.002	\$ 0.001	\$ 0.050
Kansas	\$ 0.012	\$ 0.006	\$ 0.000	\$ 0.024
Kentucky	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.029
Louisiana	\$ 0.001	\$ 0.001	\$ 0.032	\$ 0.100
Massachusetts	\$ 0.002	\$ 0.006	\$ 0.000	\$ 0.020
Maryland	\$ 0.002	\$ 0.004	\$ 0.000	\$ 0.011
Maine	\$ 0.000	\$ 0.004	\$ 0.000	\$ 0.002
Michigan	\$ 0.002	\$ 0.004	\$ 0.001	\$ 0.024
Minnesota	\$ 0.003	\$ 0.003	\$ 0.001	\$ 0.028
Missouri	\$ 0.020	\$ 0.004	\$ -	\$ 0.059
Mississippi	\$ 0.001	\$ 0.000	\$ 0.000	\$ 0.029
Montana	\$ 0.000	\$ 0.001	\$ 0.000	\$ 0.002
North Carolina	\$ 0.002	\$ 0.002	\$ 0.000	\$ 0.020
North Dakota	\$ 0.000	\$ 0.001	\$ 0.000	\$ 0.005
Nebraska	\$ 0.003	\$ 0.002	\$ 0.000	\$ 0.009
New Hampshire	\$ 0.000	\$ 0.002	\$ 0.000	\$ 0.001
New Jersey	\$ 0.003	\$ 0.014	\$ 0.000	\$ 0.019
New Mexico	\$ 0.000	\$ 0.002	\$ 0.000	\$ 0.004
Nevada	\$ 0.001	\$ 0.001	\$ 0.000	\$ 0.002
New York	\$ 0.008	\$ 0.012	\$ 0.002	\$ 0.096
Ohio	\$ 0.005	\$ 0.004	\$ 0.001	\$ 0.037
Oklahoma	\$ 0.014	\$ 0.003	\$ 0.015	\$ 0.055
Oregon	\$ 0.001	\$ 0.009	\$ 0.000	\$ 0.005
Pennsylvania	\$ 0.004	\$ 0.007	\$ 0.000	\$ 0.038
Rhode Island	\$ 0.001	\$ 0.011	\$ 0.000	\$ 0.003
South Carolina	\$ 0.001	\$ 0.000	\$ 0.000	\$ 0.022
South Dakota	\$ 0.000	\$ 0.004	\$ 0.000	\$ 0.001
Tennessee	\$ 0.002	\$ 0.002	\$ 0.007	\$ 0.070
Texas	\$ 0.017	\$ 0.004	\$ 0.038	\$ 0.204
Utah	\$ 0.000	\$ 0.001	\$ 0.000	\$ 0.004
Virginia	\$ 0.002	\$ 0.001	\$ 0.000	\$ 0.031
Vermont	\$ 0.000	\$ 0.000	\$ 0.000	\$ 0.001
Washington	\$ 0.001	\$ 0.005	\$ 0.000	\$ 0.005
Wisconsin	\$ 0.002	\$ 0.020	\$ 0.000	\$ 0.010
West Virginia	\$ 0.000	\$ 0.000	\$ 0.000	\$ 0.010
Wyoming	\$ 0.000	\$ 0.001	\$ 0.000	\$ 0.001
Total	\$ 0.199	\$ 0.245	\$ 0.140	\$ 1.461

Appendix B: Methodology

Incremental costs are estimated in three steps:

- Total incremental costs
- The distribution of costs between nursing home and non-nursing home sectors
- The distribution of costs between patient type for each sector

Total incremental costs. Total costs depend (primarily) on the incremental quantity of labor and the increase in compensation needed to attract that labor.* Dr. Alan White, using data from the OSCAR system, estimated the additional labor required to meet the proposed standards by occupation, facility type, and state. Estimates of the own-wage elasticity of labor supply for each occupation were then used to estimate the change in compensation necessary to meet the labor requirement projected by Dr. White.

As noted above, a review of the literature shows a wide range of elasticity estimates for RN. In the short run, elasticity estimates approach zero; long-run supply elasticity estimates, measured by the sensitivity of nursing school admissions to observed (one-year lagged) wages, approach one. Our RN long-run own-wage elasticity assumption is a weighted average of baccalaureate degree, associate degree, and diploma degree nursing programs estimated by Chiha and Link (see footnote 3). Our CNA long-run elasticity assumption is based on estimates for unskilled labor found in the literature (ranging from 0.4 to 1.6) combined with our expectations about different occupations; namely, that workers in occupations with substantial educational requirements would be relatively less responsive to wage changes than workers in low-skilled occupations. The LPN labor supply elasticity is estimated as the mid-point between the RN and CNA estimates.

Distribution of Costs Between Nursing Home and Non-Nursing Home Sectors. Estimates of the distribution of costs between nursing home and non-nursing home sectors involves six compensation (W) and six employment (Q) variables:

W_{toto}	= Compensation for all sectors before implementation of the standards (known)
W_{tot1}	= Compensation for all sectors after implementation of the standards (known)
W_{nho}	= Nursing home compensation before implementation of the standards (known)
W_{nh1}	= Nursing home compensation after implementation (unknown)
W_{otho}	= Non-nursing home compensation before implementation (known)
W_{oth1}	= Non nursing home compensation after implementation (unknown)
Q_{toto}	= Total hours/day for all sectors before implementation (known)
Q_{tot1}	= Total hours/day for all sectors after implementation (known)
Q_{nho}	= Nursing home hours/day before implementation (known)

* Our estimate also considers the costs of recruiting and training the additional labor. However, these costs are estimated as a proportion of compensation, so the effects of turnover rates are not included.

$$\begin{aligned}
Q_{nh1} &= \text{Nursing home hours/day after implementation (known)} \\
Q_{otho} &= \text{Non-nursing home sector hours/day before implementation (known)} \\
Q_{oth1} &= \text{Non-nursing home sector hours/day after implementation (known)}
\end{aligned}$$

The *ex ante* or "before" values-- Q_{toto} , Q_{nho} , Q_{otho} , W_{toto} , W_{nho} , and W_{otho} --are known, as is the desired number of hours per day in the nursing home sector, Q_{nh1} . If we want to construct our estimates such that employment (hours/day) in the non-nursing home sector is unchanged, then Q_{otho} and Q_{oth1} are equal and, therefore, *ex post* hours/day, Q_{tot1} , is also known.

Thus, we solve for *ex post* nursing home and non-nursing home compensation (the variables in bold above) so that the nursing home sector meets its employment target, and the net change in employment in the non-nursing home sector is zero. Theory suggests that, in order to accomplish this, non-nursing home compensation must rise. This follows since increases in nursing home compensation would tend to bid away staff from the non-nursing home sector requiring a countering compensation increase. Also, an increase in the average compensation of a particular sub-specialty (e.g., nursing home RN) might put pressure on wages in other sub-specialties (e.g., nurse practitioner) in order to preserve the prevailing hierarchy of wages across sub-specialties within a given occupation.

The distribution of costs between nursing home and non-nursing home sectors, therefore, is a function "inter-industry" or "switching" elasticities of labor supply for each occupation; that is, the willingness of workers in a particular occupation to change work settings given a change in relative compensation. If the "switching" elasticity is high, then, *ceteris paribus*, we would expect the non-nursing home share of costs to be high as non-nursing home workers shift settings in pursuit of higher wages.[†]

Ex post relative compensation levels (or elasticities), W_{nh1} and W_{oth1} , are subject to the following constraints:

- Let η_i equal own-wage labor supply elasticity for occupation i , where $i = \{\text{CNA, LPN, RN}\}$. Then $\eta_{\text{CNA}} > \eta_{\text{LPN}} > \eta_{\text{RN}}$.
- For any occupation, the own-wage total labor supply elasticity, η , must be smaller than the switching labor supply elasticity, ϵ . In words, once a worker has chosen a particular occupation, he/she is more willing to change settings within that occupation (given a change in relative compensation).
- Relative wages are determined by the switching elasticities, but cannot result in negative changes to non-nursing home sector compensation.

[†] We are assuming that some fraction of the additional nursing home staff will be new hires (i.e., new RN, LPN, CNA) and some fraction will be existing workers who are drawn from the non-nursing home sector. These fractions depend on the switching elasticities of labor supply. Non-nursing home wages will have to increase in order for the non-nursing home sector to replace workers who go to the nursing home sector. The degree to which non-nursing home sector wages must increase depends, again, on the switching elasticities.

- Nursing home sector and non-nursing home sector wage changes cannot result in nursing home/non-nursing home compensation ratios greater than one. According to BLS data, compensation levels for all three affected occupations are lower in the nursing home sector compared to non-nursing home industries (on average).[‡]
- After the implementation of the new standards, RN compensation must be greater than LPN compensation, which in turn must be greater than CNA compensation (in the long-run, for any given state).

The formulas used to compute the constraints are as follows:

Relative compensation is determined by own-wage and switching elasticities. In this case, W_{nh1} and W_{oth1} are directly computed from η and ε .

The target change in hours/day is computed by Abt:

$$\Delta Q_{nh} = Q_{nh1} - Q_{nh0}.$$

Since $\Delta Q_{oth} = 0$, then

$$\Delta Q_{nh} = \Delta Q_{tot}.$$

So, *ex post* average compensation for all sectors is:

$$(Eq. 1) \quad W_{tot1} = \left[1 + \left(\frac{\Delta Q_{tot}}{Q_{tot0}} \div \eta \right) \right] \times W_{tot0}$$

Ex post average compensation for the nursing home sector is:

$$(Eq. 2) \quad W_{nh1} = \left[1 + \left(\frac{\Delta Q_{nh}}{Q_{nh0}} \div \varepsilon \right) \right] \times W_{nh0}$$

Total labor costs for all sectors equals the sum of labor costs for each sector:

[‡] Note that this is different from the "wage parity" assumption used in the American Health Care Association (AHCA) study. AHCA assumed that non-nursing home sector (SIC 806 Hospitals) wages were "fixed" and that the proposed staffing standards would require nursing home wages to rise to the non-nursing home level. In our analysis, neither nursing home sector nor non-nursing home sector wages are fixed; each wage is solved simultaneously so that, in the new equilibrium, although wages may be equal, they may both be higher after the implementation of the proposed standards. In our approach, "wage parity" was not always a binding constraint; *ex post* nursing home compensation was often lower than *ex post* non-nursing home compensation.

$$(Q_{nh_1} \times W_{nh_1}) + (Q_{oth_1} \times W_{oth_1}) = (Q_{tot_1} \times W_{tot_1})$$

Therefore,

$$(Eq. 3) \quad W_{oth_1} = \frac{(Q_{tot_1} \times W_{tot_1}) - (Q_{nh_1} \times W_{nh_1})}{Q_{oth_1}}$$

Nursing home/non-nursing home compensation ratio must be no greater than a given target level. Under this constraint, nursing home and non-nursing home compensation is such that:

$$\frac{W_{nh_1}}{W_{oth_1}} \leq N$$

Setting the nursing home/non-nursing home compensation equal to N and solving for the non-nursing home sector yields:

$$W_{oth_1} = \frac{W_{nh_1}}{N}$$

Substituting this into Eq. 3 and solving for W_{nh_1} yields:

$$(Eq. 4) \quad W_{nh_1} = \frac{(Q_{tot_1} \times W_{tot_1})}{Q_{oth_1}} \times \left[\frac{1}{N} + \frac{Q_{nh_1}}{Q_{oth_1}} \right]^{-1}$$

Therefore, if the ratio of nursing home/non-nursing home compensation can be no greater than N, W_{nh_1} can be no greater than the RHS of Eq. 4.

The change in non-nursing home compensation must be non-negative. Equations 1 - 3 show that our methodology computes nursing home wages first; non-nursing home wages are then a residual. In other words, given nursing home compensation, non-nursing home compensation must be such that the sum of nursing home and non-nursing home labor costs equal total (all sector) labor costs.

Theoretically, then, it is possible that if nursing home compensation is computed strictly from η and ε , the change in non-nursing home compensation would be negative. To avoid this, we introduce another constraint on nursing home wages. Specifically, the change in non-nursing home compensation can only be negative if nursing home compensation is greater than:

$$\frac{(Q_{nh_o} \times W_{nh_o}) + [(Q_{tot_1} \times W_{tot_1}) - (Q_{tot_o} \times W_{tot_o})]}{Q_{nh_1}}$$

Example: California LPN calculations assuming nursing home/non-nursing compensation cannot exceed 1.0. In this case:

$$\begin{aligned}
Q_{\text{toto}} &= 174,873 \text{ (hours per day)} \\
Q_{\text{totl}} &= 181,865 \\
Q_{\text{nho}} &= 58,935 \\
Q_{\text{nhl}} &= 65,927 \text{ (target hours/day)} \\
Q_{\text{otho}} &= 115,938 \\
Q_{\text{othl}} &= 115,938 \\
W_{\text{toto}} &= \$23.37 \text{ (per hour)} \\
\mathbf{W_{\text{totl}}} &= \mathbf{Unknown} \\
W_{\text{nho}} &= \$22.41 \\
\mathbf{W_{\text{nhl}}} &= \mathbf{Unknown} \\
W_{\text{otho}} &= \$23.86 \\
\mathbf{W_{\text{othl}}} &= \mathbf{Unknown}
\end{aligned}$$

Note that the change in total LPN hours equals the change in nursing home LPN hours and that the change in non-nursing home LPN hours is zero. The change in total LPN wages is computed using the own-wage labor supply elasticity for LPN (1.1), $W_{\text{totl}} = \$24.22$.

Nursing home LPN compensation computed strictly from the switching elasticity assumption (1.4) is \$24.26. This implies a non-nursing home LPN compensation level of \$24.19. (Nursing home compensation greater than non-nursing home compensation.)

The "non-negative non-nursing home compensation change" constraint for LPN nursing home compensation is \$24.85. The nursing home/non-nursing home compensation constraint for LPN nursing home compensation is (trivially) \$24.22. In this case, the nursing home/non-nursing home compensation constraint is binding and estimated *ex post* nursing home and non-nursing compensation levels are \$24.22.

As an exercise, we estimated the hypothetical impact to the non-nursing home sector if non-nursing home wages do not increase. The results are shown in Table B.1. It is important to emphasize that these results are speculative, but they do indicate which regions of the country would be most affected by the proposed standards.

Distribution of Costs Between Patient-Types. As noted above, we don't have direct knowledge of costs by patient type. However, Alan White was able to compute incremental labor requirements for each occupation, by state, and by facility type (Medicare-only, Medicaid-only, Medicare and Medicaid, neither Medicare nor Medicaid). I.e., a vector $\mathbf{B} = \{b_i\}$, where $i = \{\text{MCR, MCD, both MCR/MCD, neither MCR/MCD}\}$. We also know the distribution of patient types by facility type (again for each state): i.e. the matrix $\mathbf{A} = \{a_{ij}\}$ where the rows, i , are as defined above, and j = the patient types {Medicare, Medicaid, Other}.

If we throw out the "both MCR/MCD" equation and assume that costs for a particular patient type are similar regardless of the facility type, we can infer per-patient costs by solving the

system of equations: $\mathbf{X} = \mathbf{A}^{-1}\mathbf{B}$ where \mathbf{X} is the (unknown) vector of incremental per patient staffing by patient-type.

Table B.1: Estimated Reduction in Non-Nursing Home Sector Hours per Day
As a Percent of Current Non-Nursing Home Sector Hours
(Assuming non-nursing home sector compensation does not change.)

Region	CNA	LPN	RN(0.2 hrs ppd)	RN(0.45 hrs ppd)
Midwest	3.5%	4.3%	0.0%	2.4%
Northeast	0.6%	2.7%	0.0%	1.4%
South	1.3%	0.5%	0.87%	4.6%
West	0.6%	2.4%	0.0%	1.3%